2011

Police vs. Smartphone DUI Apps, The Five-Minute Analyst

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Analytics Magazine.com, www.informs.org, Analytics, May/June 2011
http://hdl.handle.net/10945/40110

Police vs. smartphone DUI apps

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BY HARRISON SCHRAMM

I was struck by something I saw in the news this morning – lawmakers are concerned that so-called "DUI checkpoint apps" for smartphones would help drunk drivers avoid capture and abet them in breaking the law [1]. The story nagged at me all day; it was the sort of issue that I couldn't let go of. So I decided to ply my trade as an operations researcher and put a nickel's worth of analysis against the problem [2].

The first thing I did was field research. I downloaded two such apps: "Checkpoint Wingman" and "Phantom Alert." These apps work basically as a message board; persons who have the app can "report" a DUI checkpoint that they come across, and then these reports become part of a database. Owners of the app may then "pull" from the database the reported checkpoints and (theoretically) know whether they are at risk of getting "busted" with a DUI.

Let's assume there's a strong correlation between a person's propensity to drive intoxicated and the odds that they would be willing to post to the database [3]. If this assumption stands, then the database relies on persons who drive intoxicated frequently but don't get caught at the checkpoint to make the updates. The updates could be so time late as to be useless. Because this is the five-minute analyst, we'll assume that (substantial) problem away with a hand-wave.

Now, we can take cases on checkpoints. If the checkpoint is optimally situated, that is, in a "chokepoint" that must be crossed for the drunk to get from his starting location to his destination, there are two outcomes: either he elects to make the trip while intoxicated and is arrested, which is counted as a "win" for law enforcement; or he is deterred from making the trip and does "something else" – takes a cab, gets a driver, sleeps it off – which is also a "win" for law enforcement.

Easy enough. Now let's extend this to the case where there are two routes from the starting point to the destination. It would seem at first that the drunks would now have an advantage because they could gain knowledge about the risk of the paths. However:

1. As we discussed above, the information could be time-late.
2. The police get the same information.

There's no reason that the police can't download the DUI apps and gain intelligence about where the drunks think the checkpoints are. Because both sides have the same information stream [4], this breaks down into a two-player game (payoffs are relative to the drunks; see Table 1):

Drunks/Police	Deploy opposite DUI app	Deploy where DUI app says
Believe DUI app	-1	0
Don't believe DUI app	0	-1

Table 1: Police vs. drunks: a two-player game.

The solution to this game is a mixed strategy for both players, and any individual drunk playing against the police in this situation will have a 50 percent chance of being caught [5], the same as if there was no app at all! An identical argument will show that the odds of escaping the checkpoint are 1/n where n is the number of possible (different) routes across the checkpoint plane.

The police could take this a step further and post false information about the checkpoints. From a practical standpoint, the drunks may see "Checkpoints everywhere" and simply choose to do something else [6].

With a small amount of data and a short amount of time, we have shown that the DUI-avoidance apps are no better than useless to the user (i.e. drunk) and no worse than harmless to law enforcement. I

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1. http://techland.time.com/2011/03/23/senators-to-app-stores-get-rid-of-pro-drunk-driving-apps/

2. I do not intend to comment on the policy implications; I'm not particularly convinced whether these apps should be legal or not. What I am interested in from the OR point of view is what effect these apps have on the common good.

3. Justification: If you have a disposition to drive intoxicated, you consider knowing where the checkpoints are to be a "public good"; conversely, if you do not drive intoxicated you consider enforcement of checkpoints to be a "public good."

4. Assuming, of course, that the police can re-deploy (which is a good assumption).

5. For the game-theorists in the audience, because the value of the game is -1/2, for mixed strategy the drunks pick, the police can choose a corresponding mixed strategy and achieve the same result. This extends to the multi-road case as well, where the value of the game is -1/n

6. Critics will note that I have valued deterring DUI equally with punishing drunk drivers. Those who weight punishment above deterrence will naturally come to a different conclusion.

Armed with statistical reasoning, we may now ask the real question: How do the savings under this policy compare with the significant ethical and legal issues it raises?

In conclusion, a drug test for welfare applicants is a mathematically defensible policy. This is not the end of the debate on this issue but rather the beginning. Armed with statistical reasoning, we may now ask the real question: How do the savings under this policy compare with the significant ethical and legal issues it raises? ▮

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2. www.reuters.com/article/2011/05/31/us-florida-welfare-drugs-idUSTRE74U6W320110531
3. http://gamndally.com/2011/06/01/florida-governor-signs-controversial-drug-test-bill-into-law/
4. We set $\Delta B = N(1-P_0)(C_1 + C_2 + B)$ and solve for P_0.
5. Reporting the presence of drugs where there are none
6. Reporting the absence of drugs when they are present
7. $C_2 = B(1-P_2)$
8. Wolcott and Smith have an excellent, accessible discussion of Bayes Theorem in "The Cartoon Guide to Statistics," p.48-50.
9. The formula is: $\frac{P_0(1-P_2)}{P_0(1-P_2)+(1-P_0)(1-P_1)}$